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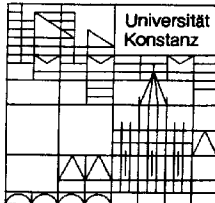
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**Income Distribution and the  
Contractionary Effect of Protection**  
A Theoretical Analysis

**INCOME DISTRIBUTION AND THE  
CONTRACTIONARY EFFECT OF PROTECTION  
- A Theoretical Analysis**

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## ABSTRACT

In terms of a simple model we show that removal of tariff from a competing foreign brand is likely to expand the size of the domestic industry when income disparities exist. A tariff increases profits of the local monopolist but is capable of cutting down the size of the local industry. After providing the general theoretical condition, we construct an example (from a class of examples) where such an outcome holds in equilibrium.

## Section I

### INTRODUCTION

Economists are often intrigued by the role of protection as a measure to promote industrialisation in less developed countries (LDC). The infant-industry argument favoring protection has been criticized at length and several parallel policies were suggested to yield more efficient results. A useful summary of the arguments is available in Krueger (1984). However, there seems to exist a general consensus on the fact that protection increases the size of the domestic industry and associated profits to the domestic producer. Protection must raise the profits of the domestic producers, otherwise there would be no incentive to lobby for protection. The crucial question is what should happen to the size of the domestic industry if a preexisting tariff (or any kind of entry-detering restriction) on the foreign products is removed. Metzler's tariff-paradox, though a theoretical possibility, does not appeal much when one tries to relate it to the incentives of local producers favoring protectionary measures. This is reflected in the fact that the tariff-inclusive domestic price must fall in the post-tariff equilibrium for the paradox to occur. Moreover, competitive general equilibrium models cannot incorporate situations where positive profits exist and matter very much in determining the optimal size of an industry.

An important feature of many less developed countries is an extremely uneven pattern of income-distribution.<sup>1</sup> A high tariff on a foreign substitute product allows only a few to consume such a product. It is also quite true that often foreign-made products are of better quality compared to the domestic brand. An interesting work analysing the quality-choice of industrial products in a LDC can be found in Esfahani (1991). With fairly uneven distribution of income, profits and industry size of a local product have a tendency to move in opposite directions. An example should clarify the point.

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<sup>1</sup> See the World Development Reports published annually by the World Bank (1985 - 1990).

Consider an economy with four potential consumers ( $A, B, C, D$ ) of a manufacturing product available in two brands, foreign and domestic.  $A$  can afford \$100,  $B$  \$50,  $C$  and  $D$  can afford only \$10 for this product of which only one unit is consumed. Consumers prefer the foreign brand to the domestic brand, i.e. if they can afford to pay for the foreign brand, they will go for it. The world price of the foreign brand is exogenously given and the domestic brand is produced by a monopolist with zero cost of production. Suppose initially the price of the foreign brand is \$50. In that case  $A$  and  $B$  purchase the foreign good. The domestic monopolist can charge \$10 from both  $C$  and  $D$  and makes \$20 as profits. Suppose now a tariff is imposed so that the tariff-inclusive price of the foreign brand is \$100.  $B$  can no longer afford the foreign brand and hence switches to the domestic brand. In the absence of price-discrimination, the domestic producer will produce only one unit of the domestic brand for  $B$ , charging \$50, rather than producing 3 units and getting \$30 as profits. More realistically, for any price between \$30 and \$50, there exists a possibility of mutually gainful trade between the domestic producer and  $B$ . The tariff has increased profits for the local producer and squeezed the industry which produces only one unit instead of two before.

The paper proposes to formalize rigorously the 'made-up' story described above. We shall show that for a wide variety of distributional patterns, tariff or any entry-deterring trade policy can have a negative impact on the industry-size. Hence, the so-called employment preserving role of tariff is challenged especially in the context of LDCs where income-distribution is relatively skewed. Protection is an issue over which local producers can lobby backed by the support of their employees. Employees can be myopic regarding the pro-competitive effect of a tariff reduction. Producers, being better informed, might know that more foreign competition would force them to produce more at a lower price and hence should have strong incentive to pamper labor-unrest in the face of anti-protectionary measures. This paper attempts to formally identify situations where a tariff raises profits but lowers domestic output and therefore does not serve its purpose as an employment-protecting device.

The paper proceeds as follows. In section II we describe the model and the equilibrium. Then we discuss the implications of changing the tariff on the foreign product. In the last section we conclude the paper after making some general remarks.

## Section II

### MODEL

Our economy consists of a population with varying levels of income indexed by a set  $\theta \in [\underline{\theta}, \bar{\theta}]$ . The income of a person belonging to the  $\theta$ th class is  $y(\theta)$  and we index it in such a way that  $y'(\theta) > 0$ . The population density function defined over  $[\underline{\theta}, \bar{\theta}]$  in  $f(\theta)$  and the simplest characterization of uneven income distribution implies,  $f'(\theta) < 0$ . As we go up the ladder, the income per person increases but the number of people earning such income goes down.

There are two brands of a product that the population can consume. The preference structure we assume is related to the one described by Gabszewicz and Thisse (1979).<sup>2</sup> The indirect utility of not consuming the manufacturing good and retaining the entire income  $y(\theta)$  is given by

$$u_0 \cdot y(\theta) \quad , \quad u_0 > 0 \quad .$$

Individuals consume only one unit of the manufacturing product. The utility derived from consuming the product is given by

$$u_i \cdot [y(\theta) - P_i] \quad .$$

$i = A$  denotes the foreign brand and  $i = B$  denotes the domestic brand.  $P_i$  denotes the prices. We assume the following ranking:

$$u_A \cdot [y(\theta) - P_A] > u_B \cdot y(\theta) > u_B \cdot [y(\theta) - P_B] > u_0 \cdot y(\theta)$$

$$\text{for } y(\theta) > P_A \quad , \quad y(\theta) > P_B \quad .$$

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<sup>2</sup> Two notable papers dealing with vertical product differentiation are by Shaked and Sutton (1984) and Flam and Helpman (1987). While Shaked and Sutton (1984) discuss the equilibrium market structure and number of equilibrium qualities in a quality differentiated product model, Flam and Helpman (1987) analyse international trade in a product cycle. To the best of our knowledge, none of the papers addresses the problem we discuss in this paper.



Also note that (3) implies  $u_A > u_B > u_0$ . (3) states that as long as  $y(\theta) > P_A$ , individuals always go for the foreign brand. Suppose  $y(\theta) \leq P_A$ , then people would go for the domestic brand as long as  $y(\theta) > P_B$ . If  $y(\theta)$  falls short of  $P_B$ , consumers would choose to retain their income as  $u_0 \cdot y(\theta)$ , in that case, gives the maximum satisfaction. The point to note is that if  $y(\theta) > P_A$ , consumers will not buy the domestic brand even if it is offered at a zero price.

In our structure we assume that  $P_A$  is exogenously given and the domestic producer, who faces zero cost of production, has to choose  $P_B$  appropriately to maximize his profits. Choice of  $P_B$  would also mean an income level above which people can afford to buy the manufacturing good. The monopolist cannot price discriminate among the customers. Let  $t$  be the initial tariff rate on the foreign brand. Therefore, the domestic price of the foreign brand is  $P_A(1 + t)$ . We assume that  $y(\tilde{\theta}) > P_A(1 + t)$ , i.e. there are some people who can buy the foreign brand.

Let  $\tilde{\theta}$  solve the following equation:

$$y(\tilde{\theta}) = P_A(1 + t) \quad (1)$$

This implies that for  $\theta > \tilde{\theta}$ , people will buy the foreign good. This leaves the potential market for the domestic monopolist to be

$$s(\underline{\theta}, \tilde{\theta}) = \int_{\underline{\theta}}^{\tilde{\theta}} f(\theta) d\theta \quad (2)$$

The producer of the domestic brand does not have to serve the whole residual market. In fact the problem facing the monopolist is to determine a cut-off income level, say,  $\hat{\theta}$  (which would also describe the price for the domestic brand,  $y(\hat{\theta})$ ), such that the profits are maximized. With zero costs of production and no price-discrimination, the monopolist's maximization problem is given by

$$\text{Max}_{\hat{\theta}} \quad y(\hat{\theta}) \int_{\hat{\theta}}^{\tilde{\theta}} f(\theta) d\theta \quad (3)$$

(see the Appendix)

This yields the following first order condition:

$$\frac{\partial y}{\partial \hat{\theta}} \cdot s(\hat{\theta}, \tilde{\theta}) - y(\hat{\theta}) f(\hat{\theta}) = 0 \quad (4)$$

$$\left( \frac{\partial s(\hat{\theta}, \tilde{\theta})}{\partial \hat{\theta}} = \frac{\partial \int_{\hat{\theta}}^{\tilde{\theta}} f(\theta) d\theta}{\partial \hat{\theta}} = -f(\hat{\theta}) \right)$$

The second order condition

$$\Delta = \frac{\partial^2 y}{\partial \hat{\theta}^2} s(\hat{\theta}, \tilde{\theta}) - 2 \frac{\partial y}{\partial \hat{\theta}} \cdot f(\hat{\theta}) - \frac{\partial f}{\partial \hat{\theta}} y(\hat{\theta}) < 0 \quad (5)$$

is assumed to be satisfied. Later we construct an example where it is actually satisfied.

Henceforth we shall use  $\hat{\theta}$  to denote the equilibrium cut-off point determined by the equation (4). The trade-off in the optimization exercise described above is quite simple. Increasing  $\hat{\theta}$  allows the monopolist to charge a higher price but from fewer people.

Going back to the equation (1), it is obvious to note that higher levels of  $t$  would lead to higher values of  $\tilde{\theta}$  as  $\frac{\partial y}{\partial \tilde{\theta}} > 0$ . Any trade policy, such as the tariff in our example, that increases the effective domestic price of the foreign brand must increase  $\tilde{\theta}$ . With more liberal policy the opposite is true.

The equilibrium size of the industry producing the domestic brand is given by

$$s(\hat{\theta}, \tilde{\theta}) = \int_{\hat{\theta}}^{\tilde{\theta}} f(\theta) d\theta \quad (6)$$

Our purpose is to find out  $\frac{ds(\hat{\theta}, \tilde{\theta})}{d\tilde{\theta}}$ .

From (6),

$$\frac{ds}{d\tilde{\theta}} = f(\tilde{\theta}) - f(\hat{\theta}) \cdot \frac{d\hat{\theta}}{d\tilde{\theta}} \quad (7)$$

From (4), differentiating with respect to  $\theta$  we get:

$$\Delta \cdot \frac{d\hat{\theta}}{d\tilde{\theta}} = - \frac{\partial y}{\partial \hat{\theta}} f(\tilde{\theta})$$

or

$$\frac{d\hat{\theta}}{d\tilde{\theta}} = \frac{- \frac{\partial y}{\partial \hat{\theta}} f(\tilde{\theta})}{\Delta} > 0 \quad (8)$$

As  $\tilde{\theta}$  increases with a higher  $t$ , more people come to satisfy their demand through purchasing the domestic brand as they cannot afford to purchase the foreign brand any longer. The domestic monopolist responds by charging a higher price, increasing  $\hat{\theta}$ .

Now from (7) and (8),

$$\frac{ds}{d\tilde{\theta}} = f(\tilde{\theta}) \left( 1 + \frac{\frac{\partial y}{\partial \hat{\theta}} f(\hat{\theta})}{\Delta} \right)$$

Substituting for  $\Delta$  from (5),

$$\frac{ds}{d\tilde{\theta}} = f(\tilde{\theta}) \left( \frac{\frac{\partial^2 y}{\partial \hat{\theta}^2} s(\hat{\theta}, \tilde{\theta}) - \frac{\partial y}{\partial \hat{\theta}} f(\hat{\theta}) + \frac{\partial f}{\partial \hat{\theta}} y(\hat{\theta})}{\Delta} \right) \quad (9)$$

we are now in a position to write down the following proposition.

*Proposition 1*

If

$$\frac{\partial y}{\partial \hat{\theta}} f(\hat{\theta}) < \frac{\partial^2 y}{\partial \hat{\theta}^2} s(\hat{\theta}, \tilde{\theta}) - \frac{\partial f}{\partial \hat{\theta}} y(\hat{\theta}) < 2 \frac{\partial f}{\partial \hat{\theta}} f(\hat{\theta})$$

then the removal of tariff must expand the size of the domestic industry.

*Proof.* Observe (9) to argue that under the condition mentioned above,  $\Delta < 0$  and the numerator is positive. Hence,  $\frac{ds}{d\tilde{\theta}} < 0$ . A decline in  $t$  will reduce  $\tilde{\theta}$  and hence increase  $s$ .

For our result to hold, the condition given in proposition 1 must be satisfied. Now let us construct a simple example where the contractionary effect of a tariff can be readily verified.

Let

$$y(\theta) = \theta^2 + \frac{1}{2}\theta \quad \text{and} \quad f(\theta) = \frac{1}{\theta} \quad \text{for } \theta > 1$$

Note that

$$y' > 0 \quad \text{and} \quad f' < 0 \quad .^3$$

We shall first calculate the effect of a change in  $\tilde{\theta}$  on the industry size in this example and then the condition given in proposition 1 can also be directly verified.

$\tilde{\theta}$  is found by solving

$$P_A (1 + t) = \tilde{\theta}^2 + \frac{1}{2}\tilde{\theta}$$

One can put values of  $P_A$  and  $t$  such that the above quadratic equation yields a value for  $\tilde{\theta}$ ;  $\tilde{\theta} > 1$  .<sup>4</sup>

<sup>3</sup> There are a large number of functions for which the comparative statics holds. For example, if  $y(\theta) = \theta^n$  then tariff has no effect on the size of the domestic industry, i.e.  $\frac{ds}{d\tilde{\theta}} = 0$ .

For  $y(\theta) = \theta^2 - \frac{1}{2}\theta$ , the usual protectionary result of a tariff would hold.

<sup>4</sup> Let  $\tilde{\theta}^2 + \frac{1}{2}\tilde{\theta} = 5$  then a solution for this equation yields  $\tilde{\theta} = 2$ .

From the first order condition,

$$(2\hat{\theta} + 1/2) (\ln\tilde{\theta} - \ln\hat{\theta}) = \hat{\theta} + 1/2 \quad (10)$$

as

$$\int_{\hat{\theta}}^{\tilde{\theta}} f(\theta) d\theta - \int_{\hat{\theta}}^{\tilde{\theta}} \frac{1}{\theta} d\theta = \ln\tilde{\theta} - \ln\hat{\theta}$$

(assuming the constant of integration to be zero).

The second order condition is satisfied as,

$$\begin{aligned} & 2 (\ln\tilde{\theta} - \ln\hat{\theta}) + (2\hat{\theta} + 1/2) \left( -\frac{1}{\tilde{\theta}} \right) - 1 \\ &= \left[ 2 \cdot \frac{\hat{\theta} + 1/2}{2\hat{\theta} + 1/2} - 2 \right] - 1/2\hat{\theta} - 1 < 0 \end{aligned} \quad (11)$$

as the bracketed term in (11) is negative.

Therefore, from (10),

$$\frac{d\hat{\theta}}{d\tilde{\theta}} = \frac{-(2\hat{\theta} + 1/2) \cdot \frac{1}{\tilde{\theta}}}{\Delta} > 0 \quad (12)$$

as  $\Delta < 0$  from (11) .

Again from (10), the industry size is given by,

$$\ln\tilde{\theta} - \ln\hat{\theta} = \frac{\hat{\theta} + 1/2}{2\hat{\theta} + 1/2} \quad (13)$$

Differentiating (13) with respect to  $\tilde{\theta}$ , we get,

$$\begin{aligned} \frac{d(\ln \tilde{\theta} - \ln \hat{\theta})}{d\tilde{\theta}} &= \frac{(2\hat{\theta} + 1/2) - (\hat{\theta} + 1/2) \cdot 2}{(2\hat{\theta} + 1/2)^2} \cdot \frac{d\hat{\theta}}{d\tilde{\theta}} \\ &= \frac{(2\hat{\theta} + 1/2) - 2\hat{\theta} - 1}{(2\hat{\theta} + 1/2)^2} \cdot \frac{d\hat{\theta}}{d\tilde{\theta}} < 0 \end{aligned} \quad (14)$$

$$\text{as } \frac{d\hat{\theta}}{d\tilde{\theta}} > 0 .$$

To verify the condition in proposition (1) note that,

$$\begin{aligned} \frac{\partial^2 y}{\partial \hat{\theta}^2} s(\hat{\theta}, \tilde{\theta}) + \frac{\partial f}{\partial \hat{\theta}} y(\hat{\theta}) &= 2(\ln \tilde{\theta} - \ln \hat{\theta}) + \frac{1}{\hat{\theta}^2} (\hat{\theta}^2 + 1/2 \hat{\theta}) \\ &= 2(\ln \tilde{\theta} - \ln \hat{\theta}) + 1 + \frac{1}{2\hat{\theta}} \\ (\text{At the optimum}) &= \frac{2(\hat{\theta} + 1/2)}{2\hat{\theta} + 1/2} + 1 + \frac{1}{2\hat{\theta}} \end{aligned}$$

$$\begin{aligned} \text{and } 2 \frac{\partial y}{\partial \hat{\theta}} f(\hat{\theta}) &= 2 \cdot (2\hat{\theta} + 1/2) \cdot \frac{1}{\hat{\theta}} \\ &= 4 + \frac{1}{\hat{\theta}} . \end{aligned}$$

Now,

$$\frac{\partial^2 y}{\partial \hat{\theta}^2} s(\hat{\theta}, \tilde{\theta}) + \frac{\partial f}{\partial \hat{\theta}} y(\hat{\theta}) - 2 \frac{\partial y}{\partial \hat{\theta}} f(\hat{\theta}) = \frac{2(\hat{\theta} + 1/2)}{2\hat{\theta} + 1/2} + 1 + \frac{1}{2\hat{\theta}} - 4 - \frac{1}{\hat{\theta}} < 0 \quad (15)$$

and

$$\frac{\partial^2 y}{\partial \hat{\theta}^2} s(\hat{\theta}, \tilde{\theta}) + \frac{\partial f}{\partial \hat{\theta}} y(\hat{\theta}) - \frac{\partial y}{\partial \hat{\theta}} f(\hat{\theta}) = \frac{2(\hat{\theta} + 1/2)}{2\hat{\theta} + 1/2} + 1 + \frac{1}{2\hat{\theta}} - 2 - \frac{1}{2\hat{\theta}} > 0 \quad (16)$$

Thus the condition in proposition (1) is satisfied.

Another interpretation of the condition can be given by looking at the elasticity of demand at the equilibrium point. As we have constructed the example,  $(\ln \tilde{\theta} - \ln \hat{\theta})$  is the total demand forthcoming at a price  $y(\hat{\theta})$ .

Hence, the elasticity of demand is given by,

$$\begin{aligned} \epsilon &= - \left[ \frac{d(\ln \tilde{\theta} - \ln \hat{\theta})}{d\hat{\theta}} \cdot \frac{d\hat{\theta}}{dy(\hat{\theta})} \right] \cdot \frac{y(\hat{\theta})}{(\ln \tilde{\theta} - \ln \hat{\theta})} \\ &= \frac{\hat{\theta} + 1/2}{2\hat{\theta} + 1/2} \cdot \frac{1}{\ln \tilde{\theta} - \ln \hat{\theta}} \end{aligned} \quad (17)$$

At a given  $\hat{\theta}$ ,  $\frac{\partial \epsilon}{\partial \hat{\theta}} < 0$  as evident from (17).

As the demand becomes more inelastic, the firm finds it profitable to increase the price and squeeze the quantity.

## Section III

### CONCLUDING REMARKS

In this paper we attempted an analysis of the contractionary effect of a tariff in an economy which is characterized by an uneven distribution of income. In this section let us point out some of the possible limitations of our analysis and how one could tackle those problems.

It might be argued that manufacturing products often come under the laws of economies of scale and therefore the producer of the domestic brand should have an incentive to increase the size of its market. While we do not deny this, we would like to point out that such a force would be offset (at least to some extent) by the existence of a small richer section of the community who can pay a much higher price for the relevant product. If there is an initial equilibrium with a declining marginal cost function, our example should continue to hold.

In this paper we have not allowed number of qualities to be a choice variable. With a continuum of qualities, our results will not hold. But with a finite number of domestic qualities, a modified version of the model should hold. Consider a monopolist producer somewhere in the quality spectrum and if the quality ranked just on top of it is taxed, he might reduce the output of the specific brand he produces.

One interpretation of our result can be given in terms of the effect of a technological progress in the foreign-made brand of the product. If its price drops due to such a change, the domestic industry must expand as it can accommodate more poor people to buy the low-quality domestic brand. A competitive domestic market will not give the contractionary result we discussed in the paper. However, a large number of LDCs have local monopoly business houses which control the manufacturing of consumer durables and other items and we treat this as the starting point. "Taxing the rich" may be a catchy political slogan but we feel that there are situations where domestic firms would choose to produce less under a tariff. Our result is strengthened if a tariff worsens the existing pattern of income distribution.



## APPENDIX

### A Technical Note

Given the assumed preference structure it is clear why people earning  $\tilde{\theta}$  will not buy the foreign brand and  $\forall \theta > \tilde{\theta}$ , everybody will buy the foreign brand. Hence,  $\tilde{\theta}$  is contained in the set over which the domestic producer maximizes the profits. However, by the same logic, if  $\hat{\theta}$  solves  $y(\hat{\theta}) = P_B$ , it will not belong to the relevant set. People with  $y(\hat{\theta})$  as income will be better off with  $u_0 y(\hat{\theta})$ . The problem with the product-form indirect utility function as described by Gabszewich and Thisse (1979) or Shaked and Sutton (1984) is that it prevents people from purchasing a better brand even when their income is just sufficient for that.

In our case such an assumption brings  $\tilde{\theta}$  into the maximizing exercise. But  $\hat{\theta}$ , technically speaking, is left out. As an approximation, choosing  $P_B = y(\hat{\theta})$  is justified and it makes intuitive sense that  $\hat{\theta}$  would respond positively to the movements in  $\tilde{\theta}$ . Also in the numerical example we show (at the beginning) that with enough discrete jump in the income distribution, our result will hold.

However, with a little alteration in the preference structure we can make  $\hat{\theta}$  contained in the set of choices available to the domestic firm.

Consider the following utilities attainable from three sources, the foreign brand, the domestic brand and the alternative one where all income is retained:

$$u_A(y(\theta) - p_A), \quad B(\theta) + u_B(y(\theta) - p_B) \quad \text{and} \quad u_0 \cdot y(\theta) \quad .$$

The first one and the last one are the same as mentioned in the paper. We alter the utility derived from the domestic manufacturing product by adding  $B(\theta) > 0$ , where  $B(\theta) = u_0 y(\theta)$ .

Also assume that if a person can just afford to buy the domestic brand, i.e.,  $y(\theta) = P_B$ , he will buy it. Hence, if  $y(\hat{\theta}) = P_B$  then people having  $y(\hat{\theta})$  will buy it even if it fetches just as much utility as  $u_0 y(\theta)$  and  $\forall \theta < \hat{\theta}$ , nobody will buy it.

The following ranking is retained:

$$u_A [y(\theta) - P_A] > B(\theta) + u_B \cdot y(\theta) > B(\theta) + u_B [y(\theta) - P_B] > u_0 y(\theta)$$

$$\text{for } y(\theta) > P_A \text{ and } y(\theta) > P_B .$$

Note that for  $y(\tilde{\theta}) = P_A$  , people with  $y(\tilde{\theta})$  level of income will choose the domestic brand if  $y(\tilde{\theta}) \geq P_B$  .

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